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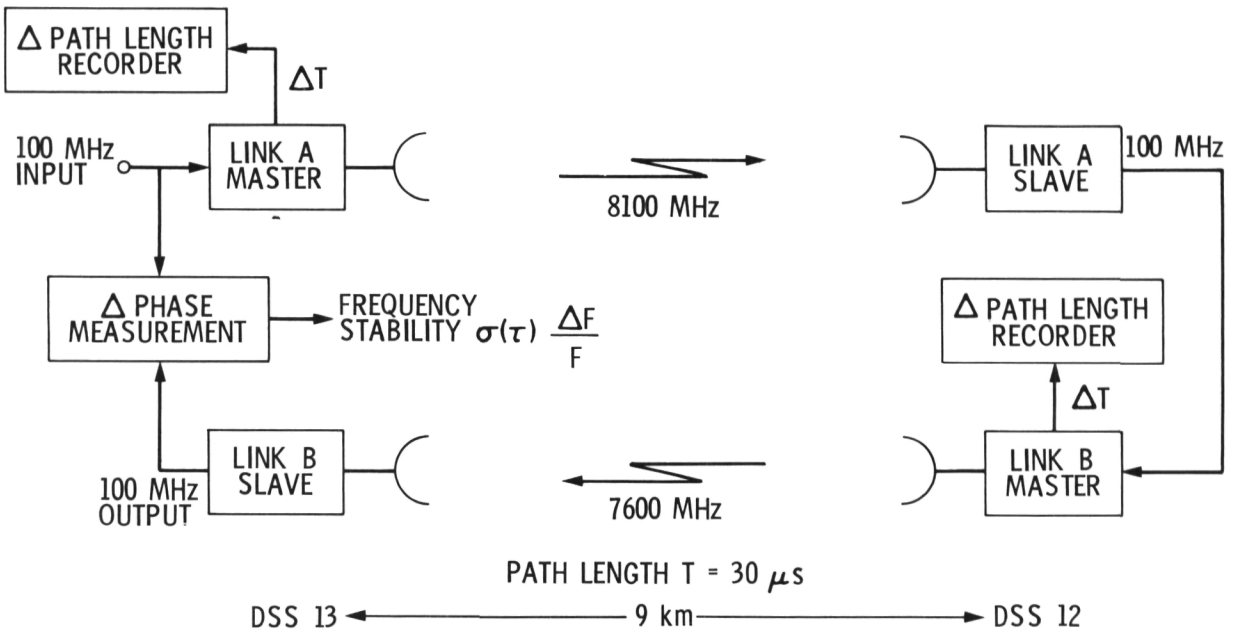
DISTRIBUTION OF STANDARD FREQUENCY SIGNALS BY MICROWAVE

JPL has completed a 9-kilometer microwave link between two deep space stations at the Goldstone complex, and demonstrated distribution of signals over the link that are stable in frequency to 1 part in 10^{15} over at least a 100-second interval. Usually, each deep space station must maintain its own frequency standard. Being able to distribute extremely stable signals between these stations means that only one set of standards needs to be maintained at each complex; all other stations can obtain their frequency and time standard signals by distribution. This represents a potentially large savings in network, complex, and station operation costs.

Frequency stability of 10^{15} or better at each station within a complex is needed for next-generation navigation systems, increased probability of gravity wave detection, and greater knowledge of the characteristics of the interplanetary propagation medium.

Most microwave links cause dramatic reduction of frequency stability over even modest distances. The 9-km link operated in conventional fashion would yield no better than a stability of 2 parts in 10^{13}. That is, variations in link path caused by electronic parts, microwave towers jostled by wind, and atmospheric effects could cause a perfectly stable signal to be received with the poorer stability. The fifty-fold improvement in stability was achieved over the link's length by utilizing a two-way stabilization technique.



Test setup of the microwave link between the Venus and Echo sites at Goldstone for distributing frequency and time standards signals. This technique provides a more stable distribution than has been possible before.